

Passive & Active Electromagnetic Frequency Selective Surfaces for High-Power Beam Applications

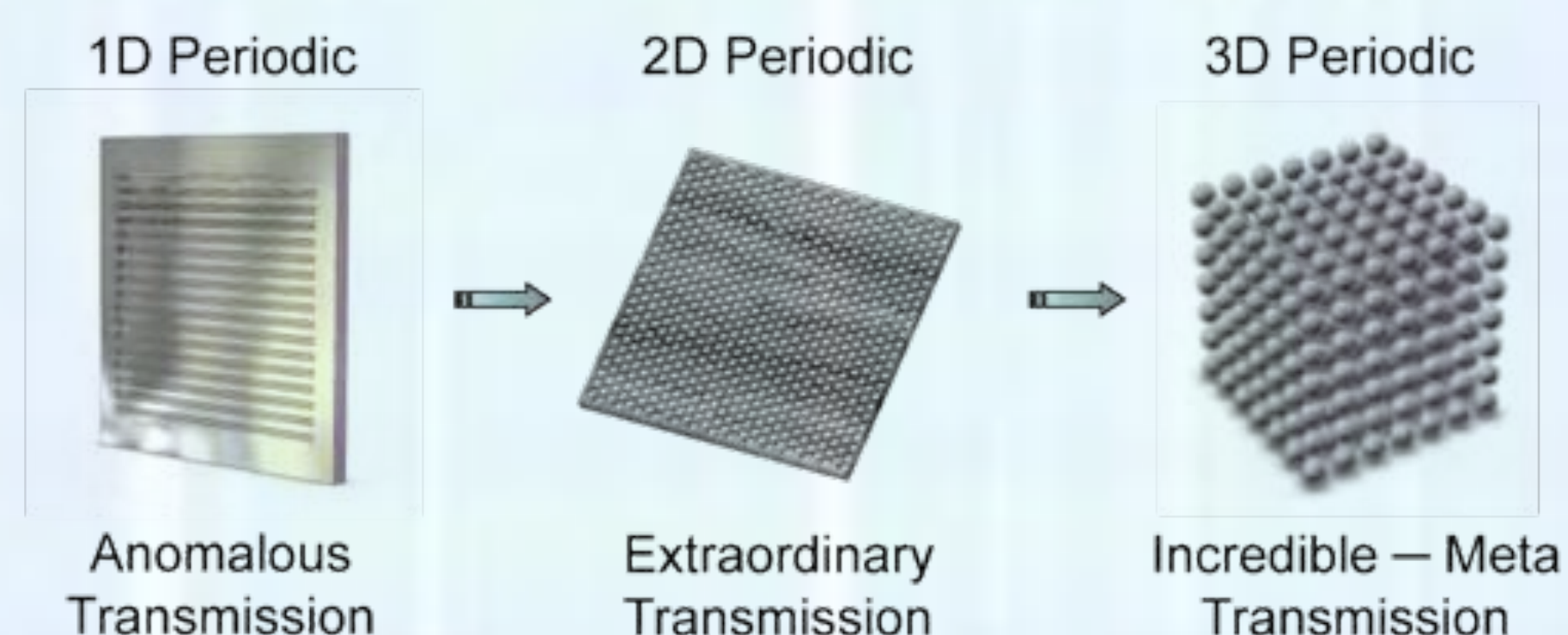


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Problem

The physics of electromagnetic scattering from complex metal/dielectric surfaces/volumes have not been completely explored and understood. It is important to study anomalous, extraordinary and double-negative transmission in order to develop useful engineering applications.



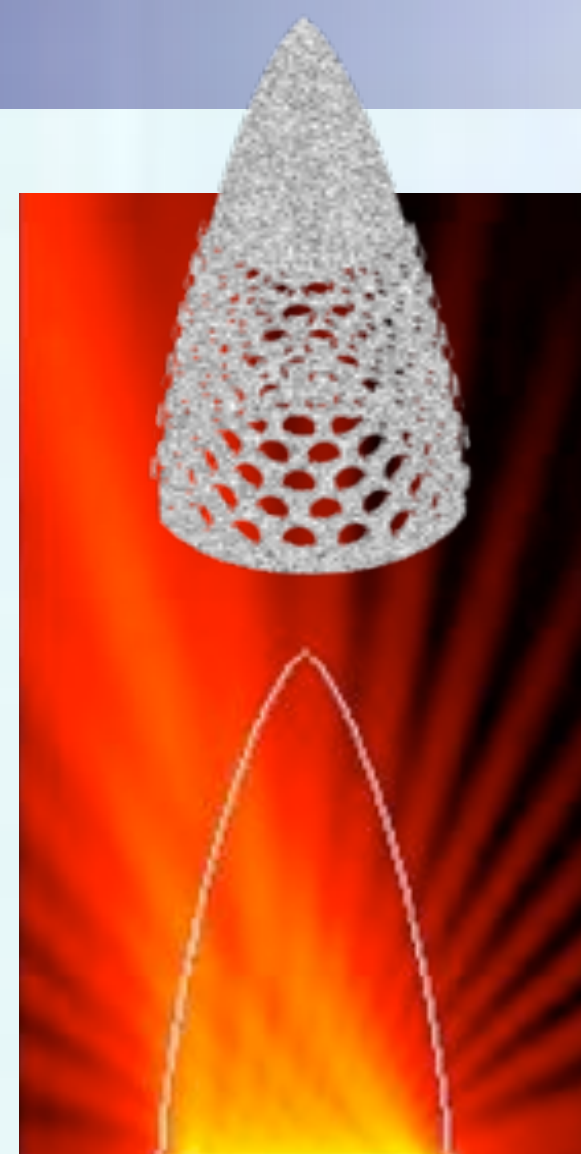
Approach

Theory: Understand the physics of EM scattering from compound periodic thick-metal surfaces.

Numerical: Develop numerical tools necessary to support theoretical and experimental work.

Experimental: Devise measurement systems to characterize novel materials and scattering processes.

Application: Produce novel, reconfigurable, metal/dielectric surfaces/volumes for adaptive control over EM scattering.



Variation of unit-cell geometry

Controls Freq. & Angle Dependence

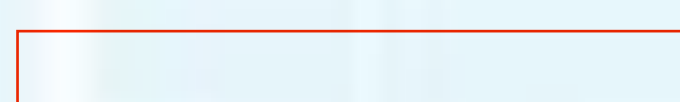
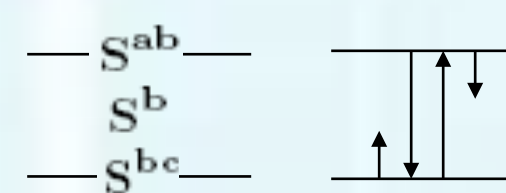
Variation of unit-cell filling

Addresses Tunability

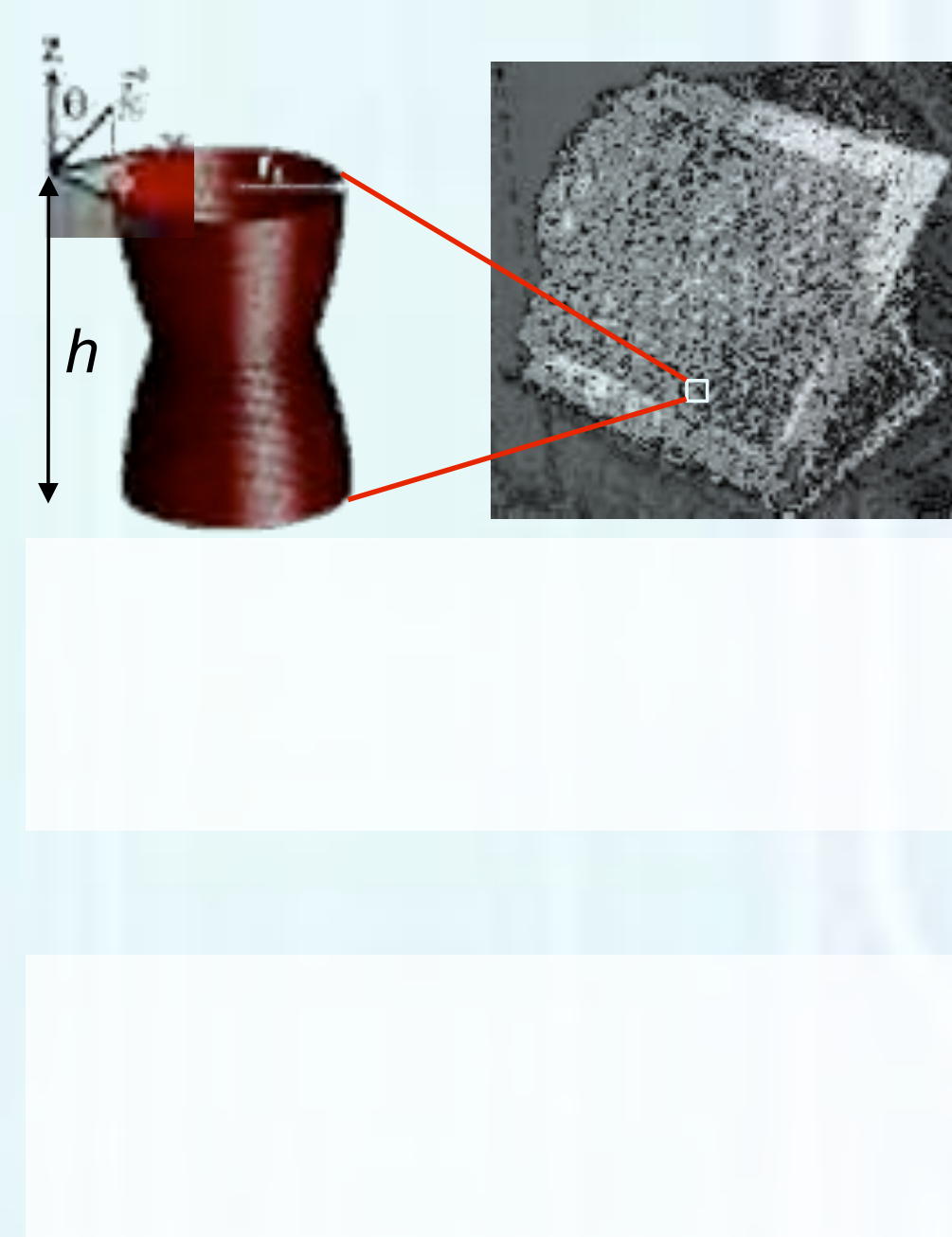
EM/RF Applications: Radome/Filters, Flat Lens, and Tunable Meta-Surfaces

Results

Tapered Perforations Improve Angle/BW Response



- Phase criterion determines resonance location
- $|\Delta_{F,R}|$ determines Q of the resonance and is dependent on the diameter/period ratio: larger diameter/period leads to broadband response

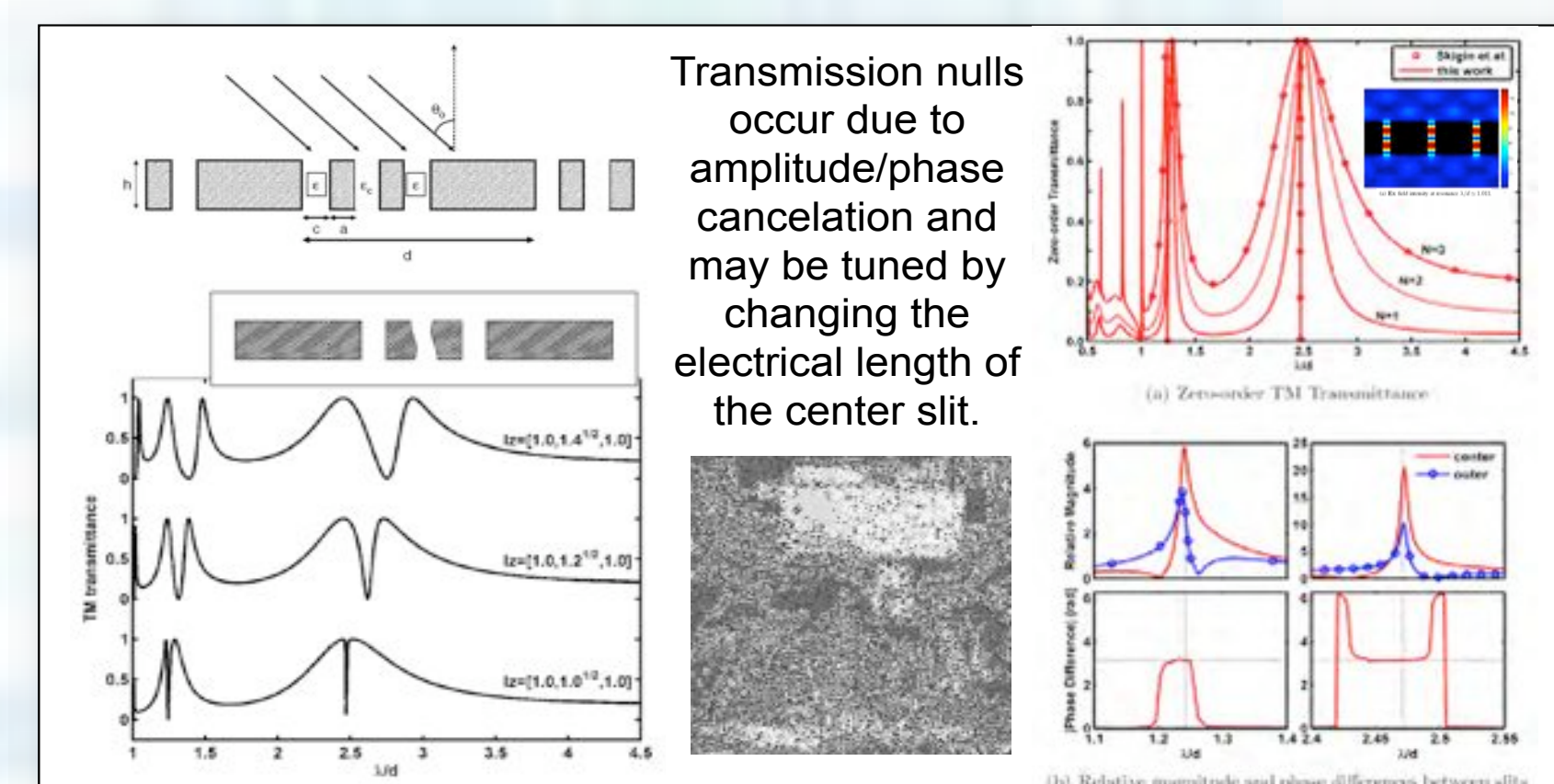


Significance

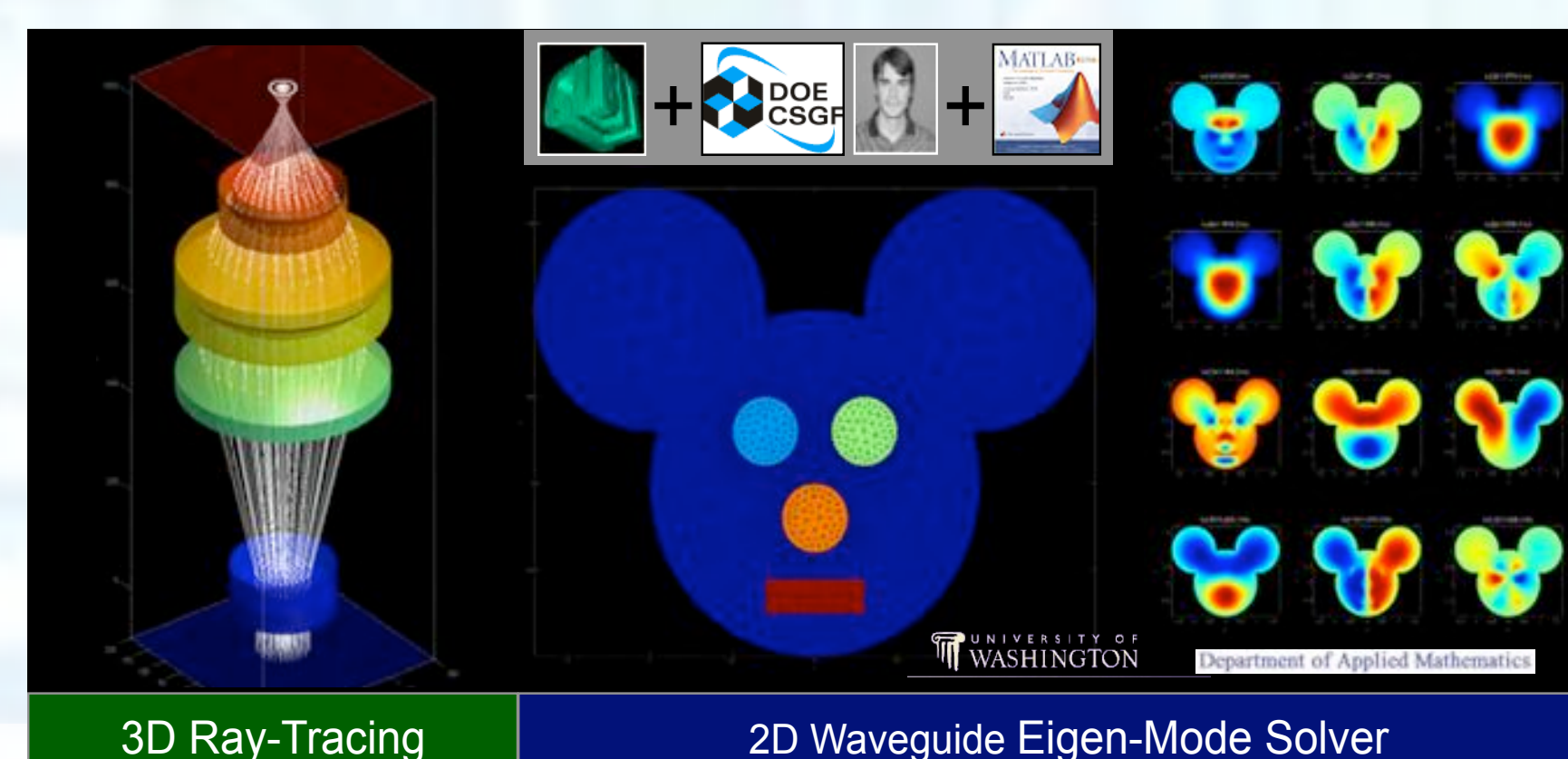
- This work satisfies the strategic intent of the Truman fellowship.
 - [multiple orgs., 3 universities, 2 graduate students, 6+ publications (one in physical review, 2 journal (in progress), 3 conference), 4 TAs, 1 additional LDRD for SAR, and supported the efforts of GC-LDRD in meta-materials]
- Provided Sandia a firm footing (tools & infrastructure) in the areas of sub-wavelength EM scattering and RF ferrite-based innovations.
- Multi-morphic surfaces open new venues for low-observables and benefit both Strategic Partnership and Defense Systems and Assessment Investment Areas.

Results (cont.)

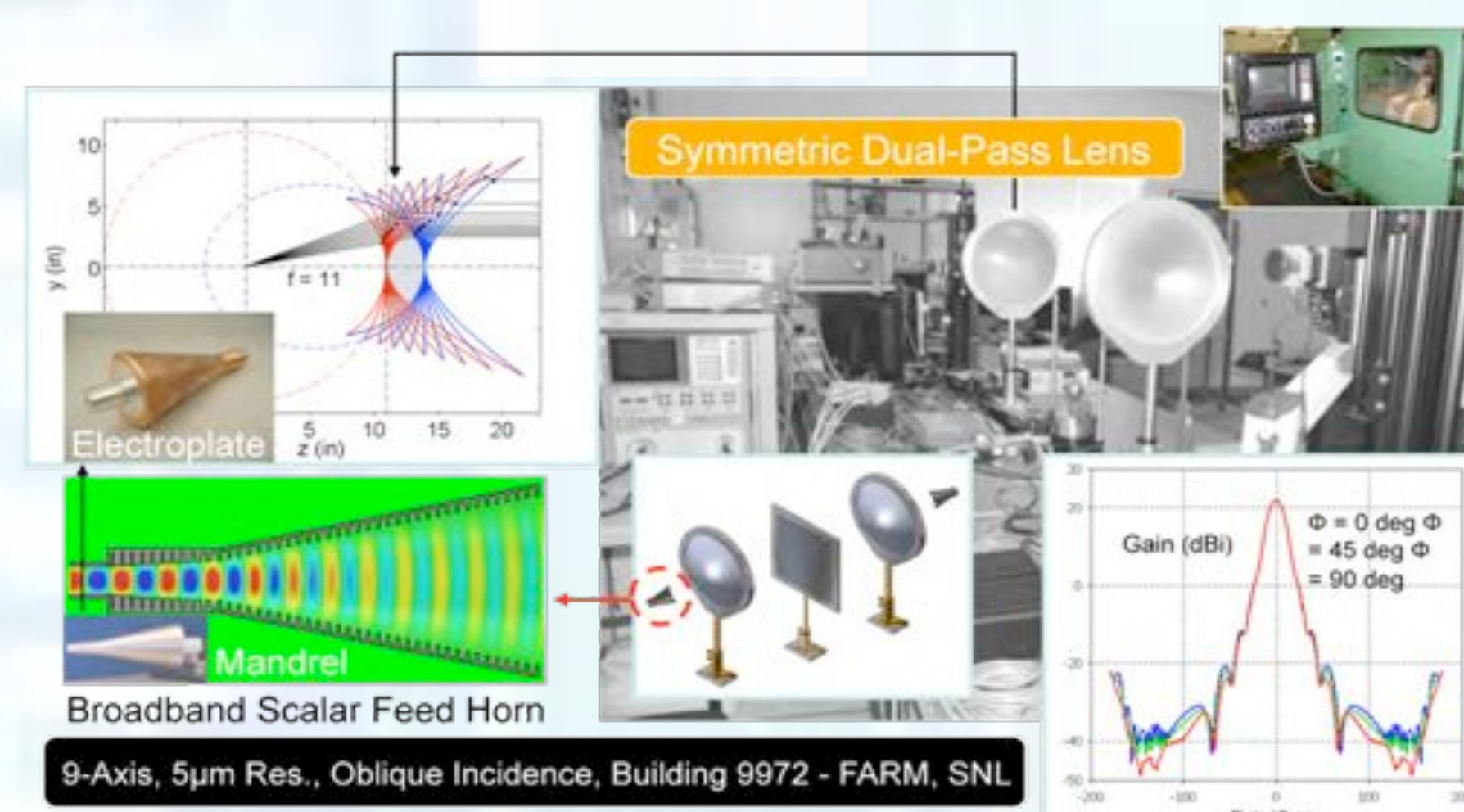
Extra Geometry Degrees of Freedom Causes Anomalous Transmission



Developed In-House Numerical Tools



Created RF Gaussian Beam Measurement System



Toward Tunable Ferrite-based Active Frequency Selective Surfaces

